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STRUCTURAL-ALGORITHMIC MEAN OF THE AUTOMATED PLANNING OF CALCULABLE MODELS

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Abstract: *The present paper is devoted to the scientific and technical solution of an actual problem of developing models and methods of the structural-algorithmic organization of parallel computing processes for enhancement of efficiency of computer systems. The method of algostructural designing of computing models has been proposed. It performs automated design of model by using library algostructures and connections among them. The algostructural models reconstruction method which provides structuring on the base of equal transformations has been improved. The calculation paralleling method in algostructures has been developed. It accounts for structure-algorithmic organization of the models and provides a calculation optimization and allows a calculation time to be decreased, available technological resources to be effectively used. The method of structural reconfiguration in problem-oriented algostructural construction is in progress development. The automated design technology of algostructural models is in progress development. The proposed technology provides effective designing of computing models.*

Keywords: *algostructural calculating model, structural-algorithmic designing.*

INTRODUCTION

There are many computer programs which allow to project and investigate computing models for various spheres of human activity. However when it is necessary to calculate great volumes of the information for a short period of time within models there a problem of paralleling computing processes in computer systems. Considering arises with significant progress in the field of designing hardware and software facilities there appeared an opportunity to solve the specified problem in the certain measure on the basis of modern scientific approaches. Thus if to implement models and the calculations connected with them in reconfigurated structures, it is possible to provide the parallelism required by means of hardware. There are many means for paralleling calculations. Unfortunately, it is difficult to automate those which were created by human. Besides reconfigurated structures require the organization of computing process which needs to be reconstructed constantly for the best use of their opportunities. It creates certain difficulties while using the specified structures and arranging of parallel calculations with their help.

1. THEORETICAL PART

Structure-algorithmic means of computer designing of models of computing processes and the organization of parallel calculations are investigated. They are realized by means of algostructural technologies. According to standard IEC 1131-3 under algostructural technology is defined as representation of models of computing processes by set of the problem-oriented components (named as algostructure) and connections between them. The urgency of work is determined by perspectivity of use algostructural technologies which allow to design effectively models and components of computing processes and to carry out structural-algorithmic transformation automatically: algorithm → structural-algorithmic model of computing process with paralleling calculations required.

It is known, that specialized computer systems are necessary for the solving of the problems containing a significant amount of computing operations. These systems should provide the best implementation of computing algorithms that is achieved by optimization and paralleling of computing process. Therefore within the framework of the given resources (algorithmic, program and hardware) it is necessary to provide a comprehensible way of creating and performing computing algorithms. For this purpose it is offered to use algostructure in this paper. Algostructure are the program models of structures putting computing

processes into practice. They can be presented in the following way: **AS = {T; X; Y; Z; N; S (K, AS$_i$); P}**, means where **AS** algostructure of the models of computing process; **T** – type algostructure; **X** – input variables; **Y** – output variables; **Z** – external options; **N** – internal options; **S** – structure algoprojected; **K** – switching; **AS$_i$** – other algostructure used in the model, **i=1,2**, …; **P** – the program of functioning.

Algostructural designing of computing models is defined as process of projecting of models and a component of computing process out of algostructure, i.e. **AS={a$_j$,A$_i$}**, where **AS** – means designed algostructure which is algoproject; **a$_j$** – algoelements (the elementary algostructure) from base library; **A$_i$** – alounits (algostructure received out of algoelements) which can be included in the structure of libraries of the user; **i**, **j** – indexes. It is reasonable to implement computing models as some structures (**S***), which are received from other structures (**S**) due to certain switching (**K**). Designing consists in generation of one algostructures on the basis of others (from library or newly designed). Algostructural designing of computing models provides a choice of necessary library components as well as their debugging and establishment of necessary connections by means of switching.

The organization of parallelism in computing models assumes performance of some transformations. Transformation of algostructure models is understood as set of actions which allow to reveal and structure parallel and consecutive calculations in algoproject: **{BLOCK, EXPRESSION, IF} → AS**. Transformations of algostructure models include: carrying out of the analysis of actions which have to be performed; revealing of dependent and independent used variables, their sorting, grouping and introducting new variables if necessary; structurizing of parallel and consecutive processes in view of sequence of their performance. Transformations use the minimal set of algoelements and simplify the problem algostructure. Paralleling of calculations in algostructures provides the following: the analysis of algorithms and revealing parallel and consecutive computing processes in them; realization of accessible ways paralleling; generation of algostructures with the set parallelism of calculations.

Reconfigurated structures are automatic devices with the programmed logic, intended for use as computers. They can be presented in the following way: ***<X, VS {K, DL, P}, Y>****,* ***DL*** *presenting logic elements;* ***P*** *– the program of functioning* ***DL****;* ***K –*** *the matrix of switching* ***DL*** *defining a configuration of computing structure* ***VS {K, DL, P}****;* ***X, Y*** *– inputs and outputs. Aalgostructure is a virtual model* ***VS {K, DL, P}*** *and is considered to be defined if* ***<X, S {K, AS (F)}, Y>*** *are given. Turning algostructures into reconfigurated structures is connected with the process in which virtual components* ***S {K, AS (F)}*** *will be replaced by corresponding components in* ***VS {K, DL, P}****. Computing algorithms are set as follows:* ***<X, F, Y>****,* ***F*** *– carried out function over* ***X*** *with the purpose of receiving* ***Y.*** ***F*** *can contain operations which are carried out consecutively, in parallel way or both. Process of realization of* ***F*** *in* ***VS {K, DL, P}*** *is a computing process. Space-time interpretation of set of used operations corresponds to a matrix of computing processes in it.*

In aloprojeced it is possible to carry out structural reorganization of problem-oriented algostructual designs which provides distributing of calculations and definition of a quantitative and qualitative set algoelements, providing algorithm performance; their configuration in algoproject; debugging of formulas in algoelements according to algorithm; formation of necessary connections between algoelements. Reorganization to make algostructural designs **(ASK)** allows from library algoelements – as structural forms of representating of computing procedures: **ASK = <K, AS (F)>**. The technology allows to make algostructural models from algounits **(AS)** and algostructural designs **(ASK)**, as structural forms of representating calculations which are sufficient enough for solving the specific task **ASM = <K, ASK, AS (F)>**. On the basis of the offered technology algostructural the models have been developed and researched by means of AlgoCAD using: the ordinary differential equations, the differential equations with edge conditions, the differential equations with partial derivatives, optimization, interpolation. Developed algostructures at most parallel computing process, provide the highest productivity and use available resources at most. However if resources are not sufficient, configuration of algostructural models will change automatically.

2. CONCLUSION

The paper proves the expediency of using of algostructural design technology of computing models. The technology allows to simplify designing by means of problem-oriented algostructurs which expand algorithmic opportunities, as well as allow to reduce designing terms of models of computing processes.